On Estimating Household Demand for Outdoor Recreation from Property Values: An Exploration

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This paper explores how hedonic price analysis might be used to estimate the surplus benefits of local outdoor recreation when distance to the recreational site is captured in property values. The model is characterized by the endogenous choice of distance to a local recreational area by households in coastal property markets and by the capitalization of proximity in property values. Equilibrium occurs when the reduction in the cost of a property due to a marginal increase in distance to the recreational area equals the associated loss in recreational surplus resulting from increased travel costs. The theoretical model is applied in an exploratory analysis of the "demand" for distance to the nearest public beach from which total surplus benefits are estimated.

Introduction

This paper explores how hedonic price analysis might be used to estimate the surplus benefits of local outdoor recreation when distance to the recreational site is captured in property values. From a historical perspective, consider that over 30 years ago Tiebout hypothesized that an individual's choice of residential location implicitly reveals demand for local public resources in a spatial economy. Nearly two decades later, Rosen's theory of implicit markets established a foundation for research on demands for property attributes. Since then, several studies reported implicit prices of distance from a residential property to local recreational sites, particularly public beaches (Brown and Pollakowski; Edwards and Anderson; Milon *et al.*; Wilman).[1] However, the fundamental relationship between the implicit price of distance and the surplus benefits of outdoor recreation has not, to my knowledge, been shown.[2]

Also in this paper, the theoretical model is applied to beach use. The need to learn more about the demand for local beach use derives from public officials who ask whether the combined benefits of angling, swimming, and other forms of outdoor recreation exceed the sometimes multi-million dollar costs of acquiring beaches and maintaining them against erosion and, reportedly, sea level rise. This is particularly true in coastal towns that are coming to grips with their responsibilities to supply beaches for local inhabitants.[3] Although

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[1] An implicit price is the price of an attribute implied by the hedonic price relationship. Mathematically, it is the partial derivative of a hedonic price function with respect to an attribute. See Rosen.

[2] Wilman estimated the "demand" for debris on an ocean beach but not for visits to a beach. Brown and Pollakowski, in a study of fresh water lakes, estimated demands for setback. Later, Brown recommended the hedonic travel cost method for estimating demands for visits to a saltwater beach, although he did not actually apply the method. However, as noted above, the hedonic travel cost method would probably be undermined by low variation in travel costs if applied exclusively to a local setting.

[3] For example, the U.S. Army Corps of Engineers has in the past been authorized by Section 103 of the River and Harbor Act of 1962 to defray up to the lesser of 70% or $1 million of the costs of small beach erosion control projects for recreation (U.S. Army Corps of Engineers, 1986a). However, the Corps' participation is currently limited to projects when "recreation benefits are less than 50% of total benefits . . . [*and* are] produced either jointly with other project benefits (recreation costs are separable), or result from development of recreation potential created by projects formulated and justified for other purposes" (Army Corps of Engineers, 1986b).

marked increases in, for example, coastal population, the number of marine anglers, beach attendance, and the variety of use-conflicts (*e.g.*, wind surfing versus swimming) are apparent, the benefits of local beach use still are largely unknown.

Not all methodologies in environmental economics can be applied, however, to estimate the surplus benefits of *local* beach use. Although the unit-day-value method could, in principle, be improved for routine use by resource managers and public officials, the present tables of unit-day-values lack both a theoretical and an empirical basis for welfare measurement (Dwyer *et al.*). In addition, the travel cost method (including the hedonic travel cost method) probably is undermined by insufficient variation in distance and, therefore, travel costs for local users. Yet including more distant users in a travel cost study would create an omitted-variables bias in regression coefficients if distant users have weaker preferences for beach use than do local users.

In contrast, the contingent valuation method, which does not suffer from the above limitations, already has been used to assess the value of beach use in Rhode Island (McConnell), New Jersey (Silberman and Klock), and Florida (Bell). Nevertheless, any methodology should, when possible, be validated, particularly when market-related information is available. Since the travel cost method probably cannot be used to validate the contingent valuation of local beach use, it is prudent to explore the capitalization of proximity to public beaches in property values.[4]

This paper presents a theoretical model of household "demand" for distance to a local recreational site when proximity is capitalized in property values. Although beach recreation is highlighted, the theoretical model applies to any local resource that is capitalized in property values. The model portrays a household evaluating tradeoffs between market prices of a coastal property and travel costs from a property to the nearest public beach. As will be seen, because distance is a choice variable in this model, we can relate implicit prices of distance to surplus benefits from beach use for local users. The theoretical model is explored by estimating the "demand" for distance from a public beach.

[4] See Brookshire et al. for an early comparison of hedonic demand and contingent valuation analyses. Their application preceded recent important advances in the hedonic price literature related to demand estimation, however.

The Theoretical Model

Distance from a household's residence to a recreational site plays a central role in recreational demand analysis. In applications of the travel cost (*e.g.*, Bockstael *et al.*) and contingent valuation (Sutherland and Walsh) methods, distance is an exogenous determinant of the money- and time-costs of travel and, therefore, the number of visits. In contrast, distance, or, proximity to a local recreational site, such as a local public beach, may be determined endogenously by households in the market for a coastal property. In such cases, distance influences both the marginal cost of a property and the travel costs of visits, including the inconvenience of local travel. Accordingly, among the things evaluated by a household in the market for coastal property is the tradeoff between reductions in property costs by purchasing a property farther from a public beach and simultaneous reductions in total visits to a beach due to increased travel costs.

To formalize this tradeoff between savings on property costs and increased travel costs, consider a household who maximizes personal utility (U) from visits (V) to local recreational sites (including a public beach), other property attributes and services (Z), and an aggregate, Hicksian commodity (X) such that:

$$U = u(V, Z, X), \tag{1}$$

with income and time constraints:

$$M = pV + cDV + R(D, Z, \epsilon) + X \tag{2a}$$

and

$$T = t_s V + t_r DV, \tag{2b}$$

where

- M = income,
- p = price vector for visits (e.g., entrance fees),
- c = round-trip money-cost per mile of travel,
- D = vector of distances from a property to local recreational sites,
- R = hedonic, or, market price of coastal property that is determined by D, Z, and the market price structure, ϵ,
- T = time budget for recreation,
- t_s = vector of on-site times for visits to recreational sites,
- t_r = round-trip time-costs per mile of travel,

and the price of X is the numeraire.[5]

For completeness, complementary slackness constraints are added to internalize the locational choices of households who buy properties either with water frontage or at or beyond the limit(s), L, where proximity to local recreational sites has no discernible effect on property values. For an internal solution:

(2c) $$D > 0$$

and

(2d) $$D < L.$$

Combining function (1) and constraints (2a) through (2d) yields the Lagrangian optimization:

(3) $$\begin{aligned} \text{maximize } G = {} & u(V, Z, X) \\ & + \lambda[M - pV - cDV - R(D, Z, \epsilon) - X] \\ & + \phi[T - t_sV - t_rDV] \\ & + \rho D + \psi[L - D], \end{aligned}$$

where λ, ϕ, ρ, and ψ are Lagrangian multipliers. ρ and ψ are greater than zero when $D = 0$ and $(L - D) \leq 0$, respectively.

The first order conditions corresponding to model (3) include

(4a) $$u_{v_j}/\lambda = (p + cd_j) + (\phi/\lambda)(t_s + t_rd_j)$$

and

(4b) $$-\partial R/\partial d_j = [c + (\phi/\lambda)t_r]v_j + (\psi - \rho)/\lambda$$

where u_{v_j} is the marginal utility of a visit to public beach, j, d_j is distance to the local public beach, and $-\partial R/\partial d_j$ is the implicit price of d_j. At equilibrium, condition (4a) requires marginal benefits to equal the marginal costs of a visit, where the second term on the right side of the equal sign is the monetized value of total time costs. This familiar result is representative of travel cost and contingent valuation studies when distance is an exogenous variable affecting household behavior. However, condition (4b) corresponds to the endogenous choice of distance when proximity to a recreational site such as a public beach affects residential choice and is capitalized in property values.[6]

Equilibrium condition (4b) is interpreted as follows. First, $-\partial R/\partial d_j$ is, literally, minus the implicit price of distance to a local public beach. Since we expect property values and distance to a local public beach to be inversely related (Brown and Pollakowski; Edwards and Anderson; Milon et al.; Wilman), $\partial R/\partial d_j$ should be negative. Accordingly, $-\partial R/\partial d_j$ can be construed as the savings from reduced property costs caused by a marginal increase in distance from a beach.

Second, the first term on the right of the equal sign in condition (4b), $[c + (\phi/\lambda)t_r]v_j$, is the loss in surplus benefits due to the increase in travel costs caused by a marginal increase in distance. This interpretation can be illustrated with a linear demand model for visits:

$$v_j = a - bC$$

where $C = [c + (\phi/\lambda)t_r]d_j$ is travel cost per visit. Total surplus benefits are:

$$S = \int_C^{a/b} (a - bC)dC = \frac{a^2}{2b} - aC + \frac{b}{2}C^2$$

where a/b is the "choke price" of visits. Finally, the change in surplus due to a marginal increase in d_j is:

$$\begin{aligned} \partial S/\partial d_j &= (\partial S/\partial C)(\partial C/\partial d_j) \\ &= -[c + (\phi/\lambda)t_r](a - bC) \\ &= -[c + (\phi/\lambda)t_r]v_j < 0. \end{aligned}$$

This result is equivalent to the first term on the right of the equal sign in condition (4b).[7]

The second term on the right of the equal sign, $(\psi - \rho)/\lambda$, is the net effect of the complementary slackness constraints. For a property with water frontage, $d_j = 0$, $\rho > 0$, $\psi = 0$, and marginal savings (i.e., $-\partial R/\partial d_j$) are less than the corresponding marginal loss in recreational surplus. Conversely, for households who choose to live beyond the limit that proximity is capitalized in property value, $d_j \geq l_j$, $\psi > 0$, $\rho = 0$, and marginal savings are greater than the marginal loss in recreational surplus.

[5] This theoretical model can be generalized to a household production framework with production constraints on visits (V) and with activity inputs and prices specified in the income constraint. Instead, it is assumed, following Burt and Brewer and others, that household technology for visits is a Leontief, fixed proportions technology with fixed on-site and marginal costs per visit. Also, possible tradeoffs between leisure time and work time previously discussed by Bockstael et al. are not modeled. Only the relationship between visits to and distance from a local resource is explored here.

[6] It turns out that this theoretical model resembles Muth's spatial model of urban residential land use. One important difference, though, is that the one component of property that is developed in this paper (i.e., distance to a local recreational site) is taken out of the overall housing bundle and related directly to demand for the recreational site.

[7] The minus sign indicates that surplus declines when travel costs increase.

Since hedonic demand analysis of distance cannot be used to estimate surplus benefits of beach recreation for these two groups of households, the remainder of the paper will concentrate on internal solutions to model (3).[8]

The equilibrium defined by condition (4b) for an internal solution is illustrated in Figure 1 with a linear visits demand curve. The lower left quadrant shows an "upside down" inverse demand curve for visits to a public beach. Its vertical axis is the marginal costs of a visit, which is composed of total travel costs per trip [*i.e.*, $(c + (\phi/\lambda)t_r)d_j$], an entrance fee (p), and on-site time costs [$(\phi/\lambda)t_s$].

The total surplus benefits behind the visits demand curve are what we seek to measure, although the demand curve is unknown. However, the line in the upper left quadrant translates marginal surplus in visits demand space [*i.e.*, $(c + (\phi/\lambda)t_r)v_j$] onto the upper right, distance quadrant where marginal surplus is revealed by the marginal loss curve. Thus, the line segment between the distance axis and the marginal loss curve measures the loss in surplus benefits resulting from a marginal increase in travel distance. In contrast, marginal savings in the property market are traced by the implicit savings schedule, or the partial derivative of the hedonic price equation with respect to distance $(-\partial R/\partial d_j)$. At equilibrium, $dj = d_j^*$, and condition (4b) is satisfied.

The marginal loss curve and, therefore, the surplus benefits of beach use are revealed by implicit savings at the intersection of the two curves. When $d_j < d_j^*$, marginal savings in property costs exceed marginal losses in surplus benefits and the household has incentive to locate beyond d_j. Conversely, when $d_j > d_j^*$ marginal savings in property costs are less than marginal losses in surplus benefits, and the household chooses to live closer than d_j. It also follows that the entire area behind the marginal loss curve and beyond d_j^* is total surplus benefits that are not given up.[9] In Figure 1, surplus *ABE* is captured by area *abe*.

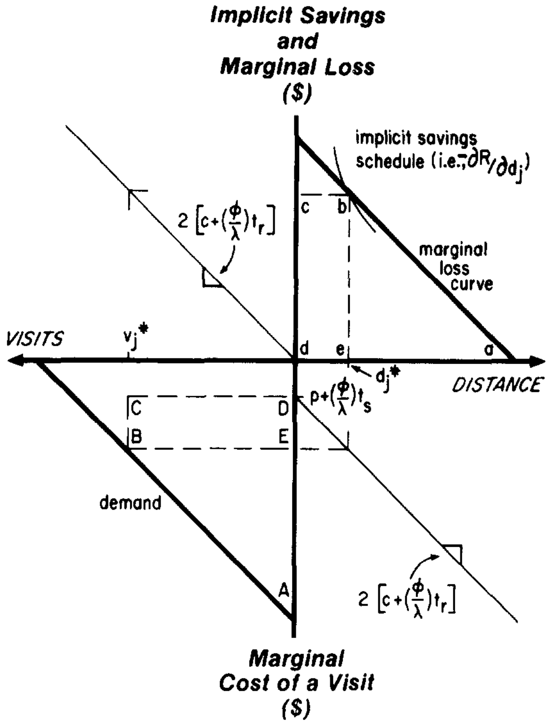

Figure 1. The "demand" for distance to a local public beach reveals surplus benefits from beach recreation.

Finally, the lower right quadrant transforms the distance axis onto the travel cost axis with a line with slope $[c + (\phi/\lambda)t_r]$. This line hits the travel cost axis at the value for the entrance fee (possibly zero) plus on-site time costs.

An Exploratory Application

The "demand" for distance

Recently, several researchers, particularly Diamond and Smith and Mendelsohn, explained that the identification problem associated with hedonic price analysis involves simultaneous choices of both the implicit price (*i.e.*, implicit savings in this paper) and the quantity of an attribute—not attribute supply and demand as initially argued by Rosen. That is, conceptually, a household moves along an implicit price schedule, such as that illustrated in the upper right quadrant of Figure 1, until the price, or, marginal cost of the attribute is equal to marginal willingness-to-pay. Because

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[8] Although not explored here, implicit demands for water frontage may reveal demands for beach use by owners of waterfront property. However, households living beyond the limits, L, must be studied with the travel cost or contingent valuation methods.

[9] Although surplus benefits are our primary concern, notice that the entire area behind the marginal loss curve and below a value for marginal loss is an incomplete estimate of total benefits. That is, total benefits in visits demand space (area ABv_j^*d) are underestimated by area DCv_j^*d in distance space because entrance fees and on-site time costs are not affected by distance.

of the simultaneous nature of this choice, a simultaneous equations estimator such as two-stage least squares is required for demand estimation.

Looking again at the upper right quadrant in Figure 1, imagine how a shifting implicit savings schedule would identify the "demand" for distance, or the marginal loss curve, provided that the necessary exclusion criteria are satisfied. Diamond and Smith favor using multiple-market data to identify the demand for an attribute, particularly when markets are represented in the hedonic price model by the specification of a variable for time period. They report, though, that attribute demand can also be identified with single market data by either specifying a sufficiently non-linear hedonic price model, such as that resulting from Box-Cox power transformations of the variables (*e.g.*, Edwards and Anderson; Milon *et al.*), or by restricting the coefficients for other housing attributes to be zero in a given demand model (*i.e.*, by imposing separability) as illustrated by the Harrison and Rubinfeld study. All three approaches were used here.[10]

Mindful of the identification problem and the developmental status of hedonic demand analysis,[11] Edwards and Anderson's hedonic price model (Table 1) and data set (353 observations) for actual market transactions of residential properties in the small coastal town, South Kingstown, RI were used to explore estimation of surplus benefits behind a marginal loss curve. The model's specification with 21 variables was determined in part from a survey of recent buyers, 72% of whom ranked close proximity to a public beach as "most important" (44%) or "very important" (28%) in their residential choice. In addition to common attributes such as number of bathrooms, size of house, and lot size, the hedonic price model also controls for the influence of water-related attributes that are somewhat correlated with distance to the nearest public beach (water frontage, water view, and distance to the nearest coastal saltwater pond), thus minimizing any omitted-variables bias on the coefficient for distance to the nearest public beach that would carry over to the demand analysis.[12] Finally, the Box-Cox power transformations used by Edwards and Anderson resulted in a non-linear functional form for the hedonic price model. See Edwards and Anderson for further details.

Two-stage least squares was used to estimate the inverse "demand" for distance to the nearest public beach. In the first stage, distance of a property to the nearest public beach is regressed on all the exogenous variables in the system. Assuming that utility is separable in distance and all other property attributes, the list of exogenous variables includes the 20 attributes represented by the vector, Z, in the hedonic price model. The final exogenous variable, household income, was derived from a correlation between income and the price of property that was estimated from the household survey.[13]

Next, recall that the implicit price of distance to the nearest public beach reveals the marginal loss in surplus benefits. Accordingly, in the second stage, the implicit price of distance was derived from the hedonic price model and regressed on income and the instrumental value of distance using ordinary least squares.[14] The resulting inverse "demand" model is:

[10] In addition, Ohsfeldt and Smith (1985) illustrate that even a technically identified demand model will be undermined unless there is at least 25% variation in implicit prices attributable to the exogenous sources of implicit price variation. In this exploratory study, more than 50% of the variation in implicit prices (savings) for distance to the nearest public beach is attributed to the three exogenous sources of variation in implicit prices.

[11] Recently, Bartik and Epple extended Diamond and Smith's discussion of the identification problem, particularly with regards to selection of characteristics that can be used as instruments when estimating attribute demand. The selection centers on the form of the unknown, underlying utility function (Bartik) and whether attribute supply is also endogenous to the system. These studies underscore the developmental status of applied hedonic demand analysis.

[12] In this application, multicollinearity among these water-related variables was not an apparent problem. For example, the correlation between distance to the nearest public beach and distance to the nearest saltwater lagoon (both measured along streets to points for public access) was only 0.51. In general, though, one should be aware of possibly attributing too much value to distance when other spatial attributes are omitted from a hedonic price model because of severe collinearity or measurement problems.

[13] Income reported by the Bureau of the Census could not be used in this study because South Kingstown, RI has only a few Census tracts and the arrangement of even these tracts did not conform to the distribution of public beaches. This deficiency is even worse for extensive areas of the coast which are not tracted. However, Edwards and Anderson used data from a survey of 63 recent buyers to estimate the following relationship:

$$\text{Income} = 44{,}979 + 0.23\ \text{Price} - 4972\ \text{Bedrooms} - 1029\ \text{Rate}$$

where "Price" is market price, "Bedrooms" is number of bedrooms, and "Rate" is the mortgage rate ($R^2 = 0.4$). Notice, however, that because this model is not a cause-effect relationship (e.g., the price of a property does not determine household income), it is not part of the simultaneous system of equations. The income model expresses a correlation among variables and is used to derive the exogenous variable, household income.

[14] Ohsfeldt and Smith (1988) report that parameter estimates in attribute demand models are more accurate when the "explained" variable is marginal benefits (losses).

Table 1. Optimal Functional Structure of Hedonic Price Model for Coastal Property in South Kingston, RI (see Edwards and Anderson)

[n = 343; R^2 = 0.73; (θ, η) = (0.32, 0.66)][a]

Attribute	Coefficient	Standard Error
DISTANCE TO THE NEAREST PUBLIC BEACH (miles)	**−0.98**	**0.30**
Lot size (square feet)	0.0028	0.00071
Square footage of house	0.052	0.009
Number of bathrooms	6.23	0.89
Square footage of garage	0.046	0.009
Square footage of basement	0.010[b]	0.008
Number of fireplaces	1.80	0.38
Age of house (years)	−0.58	0.10
Age squared	0.012	0.004
Local population density	−0.003[b]	0.005
Distance to the University of Rhode Island (miles)	−0.53[b]	0.38
Distance to nearest grade school (miles)	−0.25[b]	0.40
Distance to shopping center (miles)	−0.40[b]	0.38
Distance to the nearest saltwater lagoon (miles)	−0.40[b]	0.45
Frontage on a saltwater lagoon (feet)	0.19	0.04
Frontage on freshwater pond (feet)	0.05[b]	0.07
View of saltwater lagoon or ocean (yes = 1; no = 0)	3.25	1.07
View of freshwater pond (yes = 1; no = 0)	1.29[b]	1.60
Surrounding area wooded (yes = 1; no = 0)	2.68	0.83
Surrounding area marshy (yes = 1; no = 0)	−4.07	2.03
Time (1979 = 1; 1980 = 2; 1981 = 3)	0.48	0.08
Intercept	89.59	3.05

[a] Box-Cox transformations on the variables were used whereby $Price^{(\theta)} = (Price^{\theta} - 1)/\theta$ and $x_i^{(\eta)} = (x_i^{\eta} - 1)/\eta$ except for dummy variables.
[b] All coefficients except these are significant at the 5% level or better.

$$\text{(5)} \quad \text{Marginal loss} = \underset{(17.9)}{2837.3} - \underset{(-27.6)}{224.7}\text{Distance} + \underset{(6.58)}{0.0312}\text{Income}$$

(t-statistic)

$$N = 353;\ R^2 = 0.36;\ F = 63.4$$

A Glejster test on the distance variable was used to adjust the data for heteroskedasticity.[15]

As one might expect from the theoretical model portrayed in Figure 1, the marginal loss in surplus benefits is estimated to decrease with distance from a local public beach. That is, as distance and, therefore, travel costs increase, losses of surplus benefits decrease. In addition, the positive coefficient on income confirms that beach recreation is a normal good.

Surplus benefits

Recall that total surplus benefits in visits-demand space (*e.g.*, area *ABE* in Figure 1) is measured by the area behind a "distance" demand curve and beyond the household's location (*e.g.*, area *abe*). Hence, despite the exploratory nature of the demand analysis, preliminary estimates of total surplus benefits for local beach use are of particular interest.

Figure 2 summarizes examples of total surplus benefits derived from "demand" model (5) for various combinations of distance and income. These estimates range from $1,788 for a household making $10,000 annually (in 1980) and living 10 miles from the nearest public beach to $46,706 for a household making $60,000 and living only 0.5 miles from the beach. Estimates of surplus benefits for actual

[15] Semi-log and log-linear specifications provided similar fits to the data. However, these models were not used to estimate total surplus benefits (i.e., area *abe*) because of inherent limitations. Specifically, the log-linear model did not intersect the distance axis. In contrast, the semi-log model using the natural log of distance did intersect the distance axis, but the values for distance corresponding to point *a* were well beyond the range of the data set. Consequently, the linear model was used to facilitate the estimation of total surplus benefits in this exploratory analysis. Linear models have been used in other hedonic demand studies (*e.g.*, Mendelsohn).

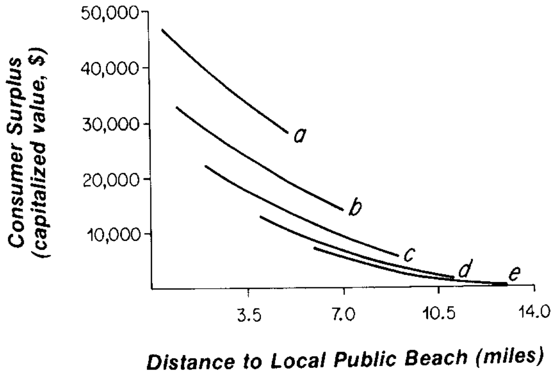

Figure 2. Influence of distance and income on total surplus benefits [see model (5)]. Annual income is: (a) $60,000; (b) $40,000; (c) $25,000; (d) $15,000; and (e) $10,000.

observations in the data set range from $2,311 to $70,404. Notice, however, that these estimates are the *capitalized* values of surplus benefits. In addition, the estimates are of total (not changes in) surplus benefits and for an entire household.

As an attempt to put these preliminary results into perspective, the capitalized surplus benefits were annualized over a 50 year period, using the average mortgage rate of about 13% during the study period as a measure of the household's private discount rate.[16] Accordingly, annualized surplus benefits corresponding to Figure 2 range from $232 to $6,071 for a household. In addition, the annualized benefits corresponding to the properties in the data set range from $300 to $9,152.

Finally, dividing the annualized values by 3.5, or, the approximate average size of households in South Kingstown, RI, yields average annual surplus benefits per capita. Accordingly, surplus benefits per capita range from about $66 to $1,735 for the same pairs of distance and income as above, and from about $86 to $2,615 for the data set (still in 1980 dollars). From this perspective, the preliminary estimates of total surplus benefits are "plausible," particularly since they are for all types of beach use during an entire year.

Summary and Discussion

This paper presented a theoretical hedonic price model for estimating the surplus benefits of outdoor recreation from property values. The model portrays a household's endogenous choice of distance to a local recreational site and the dependency of both the price of property and travel costs on this choice. Equilibrium occurs when savings on the costs of property from choosing a location which is marginally farther from the local site equal the associated loss in surplus benefits resulting from increased travel costs and, therefore, reduced visits.

The exploratory demand and surplus analyses of beach use yielded "plausible" results. Nevertheless, there are at least four areas that require research before the accuracy and efficacy of the procedure can be judged. First, although not an apparent problem in this study, severe collinearity between distance to a local public beach (or any spatial resource for that matter) and other spatial attributes could bias estimates of implicit savings and, therefore, surplus benefits.

Second, even when the coefficient on distance to the nearest public beach is unbiased, it is not likely that this procedure could ever be used to estimate surplus benefits for individual activities such as sunbathing, swimming, surf fishing, surfing, or wind surfing. Thus, to the extent that this procedure becomes useful, it will most likely be limited to estimating the aggregate surplus benefits of all beach uses.

Third, there is the issue of how surplus benefits should be aggregated across local households. It is not clear, for example, that households who bought property before the time period of a data set have similar preferences to recent buyers. Also (and as remarked when discussing the complementary slackness conditions), surplus benefits enjoyed by households who abut a local recreational site or who live beyond the distance where proximity affects property value [*i.e.*, beyond L in constraint (2d)] are not revealed behind a distance "demand" curve. Therefore, a complete assessment of surplus benefits would require complementary studies, including, perhaps, hedonic demand analysis of water frontage.

Finally, how should *changes* in surplus beneath a distance "demand" curve be measured? One possibility is to assume that all local beaches are virtual perfect substitutes such that the loss or addition of a beach would change total surplus benefits by changing a household's proximity to a public beach. In

[16] Given this long time period, annualized surplus is approximately the capitalized value times 0.13.

this case, distance plays the same role as price in usual demand models.

Given the above challenges to modeling the "demand" for distance—coupled with general problems surrounding hedonic demand analysis such as collecting household-specific information on income and substitutes, specifying resource quality such as crowding, and the various challenges studied by Graves *et al.* regarding the estimation of hedonic price functions—the contingent valuation method may have a comparative advantage when estimating the surplus benefits of local recreational resources such as beaches. Nevertheless, the foregoing theoretical and empirical analyses has some positive aspects. First, this study suggests that travel cost, hedonic travel cost, and contingent valuation studies of demands for beach recreation should specify the endogenous choice of distance made by the sub-population of local users when proximity is capitalized in property values. Local users incur additional, fixed costs related to beach use such as mortgage payments.

Second, although somewhat speculative, the effect of distance on surplus benefits illustrated in Figure 2 at least highlights the possibility that local users have stronger preferences for beach use than do distant users. If so, not controlling for differences in preferences could easily lead to omitted variables bias in the travel cost coefficient of contingent valuation and travel costs models.

Third, the theoretical model is a small contribution to an overall synthesis of hedonic demand, travel cost, andontingent valuation methodologies when distance to a local recreational site is an endogenous choice made by households in real estate markets.

Finally, although limited to only part of the user population, the favorable results of the exploratory demand analysis holds promise for using hedonic demand analysis of distance to validate contingent valuation studies of local public resources. Given the great flexibility and efficacy of the contingent valuation method and its potential role in providing scientific information to the policy process, opportunities to validate the credibility of the contingent valuation method should not be overlooked.

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